Pneumatic Transfer System and Packing System for the Moon

Tai Sik Lee[1], Leonhard E. Bernold[2], Dongcheol Choi[3], Byung Chul Chang[4], and Junwoo Tak[5], [1]Civil and Environmental Engineering, Hanyang University (cmtsl@hanyang.ac.kr), [2]School of Civil & Environmental Engineering, University of New South Wales(leonhard.bernold@gmail.com), [3]Civil and Environmental Engineering, Hanyang University (Dongcheol.choi@gmail.com), [4]Civil and Environmental Engineering, Hanyang University(bcc@hanyang.ac.kr), [5]Civil and Environmental Engineering, Hanyang University(cmtsl@hanyang.ac.kr). [2]Taeyoung E&C (supermario1983@hotmail.com),

Introduction: Since the first steps on the Moon in 1969, human explored and studied about the Moon. Exploration not only helps us understanding lunar environment, but also opens up new opportunities in developing new resources such as helium-3 (He-3).

Background: Many engineers and scientists who may concern extra-terrestrial development, study this field, and they suggest In-Situ Resource Utilization (ISRU) project. In the lunar environment, ISRU extract oxygen and other elements from the lunar regolith. Transport raw material to the extract plant is one of the important things for the project success.

Pneumatic Transfer System and Packing System: Several systems for transfer materials are suggested for the lunar environment, but by using pressurized gas system, that usually called Pneumatic Transportation System, gives most noticed outcome in this field. However, due to the low lunar gravity, it is hard to see any gases on the lunar surface. For that reason, key factor of pneumatic transportation system is to reuse gas.

Design Prototype of Pneumatic Transfer System: The entire factor in lunar environment is different from the terrestrial environment, thus adapting pneumatic transportation system in the lunar environment should begin with basic steps. In this study, prototype of the lunar soil pneumatic transportation system is developed and experimented to test possibility and feasibility. .

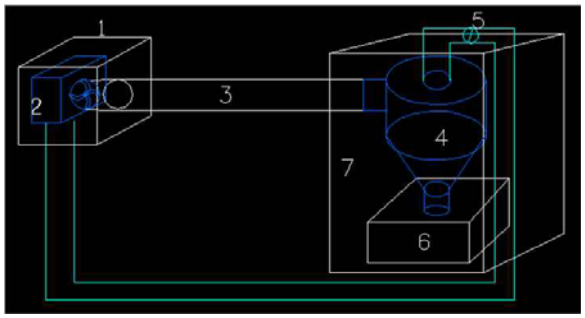

Figure 1 Concept of Pneumatic Transfer System

Packing System: Moreover, this study deals with packing system. The suction machine inhales the lunar soil, making the hole. It is found out the problem that the hole should be filled up. Packer System could be the one of the solution for figure out this problem. Packer system must block the effluence of gas and not separate from the hole, so packer system prototypeis developed. Concept design, demonstration, and perform test will be introduced on the presentation.

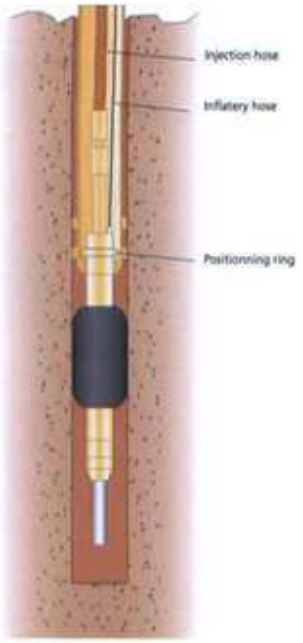

Figure 2. Terrestrial Packer System

Recommendation: While developing the system, lunar regolith should separate from transfer gas. Cyclone and particle filteration system could adapt for that process. Therefore optimal model of separation system should be considered to develop pneumatic transportation system

References: [1] Robert P. Mueller, Ivan I. Townsend III, and James G. Mantovani.(2010) "Pneumatic Regolith Transfer Systems for In-Situ Resource Utilization", Earth and Space 2010: Engineering, Science, Construction, and Operations in Challenging Environments © 2010 ASCE